

tuations (chapter 9), work fluctuations (chapter 10) and heat fluctuations (chapter 11) in steady state non-equilibrium systems. These are among the items of contemporary research in statistical mechanics.

The epilogue (chapter 12) nostalgically surveys the journey and this is followed by the references cited in the text as well as a list of supplementary reading. There is a short index at the end. The book is thus a simple guide to some of the recent developments in thermodynamics and statistical physics, extending the understanding of equilibrium systems to non-equilibrium systems in a steady driven state. It is not a textbook nor will a new entrant be able to appreciate the finer aspects of the exposition.

What more should one say, in addition to recommending it for reading as a supplementary material? Slips in editorial work are very few, like top/bottom instead of left/right on page 15. Should anything be added in say the next re-printing? Although the fluctuation of energy in a canonical ensemble is discussed in section 7.2.1, a simple extension that, for a gas of N particles, the mean square fluctuation goes as $1/N$ and is hence too small to be observed for almost all cases, would have been a useful example of the stability of the thermodynamic averages. In chaos theory the concept of 'attractors' has a special meaning and yet the word is quietly slipped in chapter 8 without any explanation.

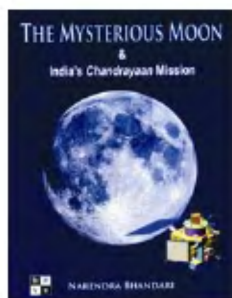
Among the tidbits about curious historical events, one may add the famous advice of Lord Rayleigh to ambitious young scholars, which is valid even today. Rayleigh as the Secretary of the Royal Society, London, got the paper of J. J. Waterston of Bombay published in 1893, though it was submitted in 1845 and rejected by the referees. Rayleigh wrote a 5-page introduction to the 75-page paper (*Philos. Trans. R. Soc. London*, 1893, 183A, 1–79), starting by how his attention was drawn to this paper buried in the archives of the Society and then going on to say 'The history of this paper suggests that highly speculative investigations, especially by an unknown author, are best brought before the world through some other channel than a scientific society, which naturally hesitates to admit into its printed records matters of uncertain value. Perhaps one may go further and say that a young author who believes himself capable of great things

would usually do well to secure the favourable recognition of the scientific world by work whose scope is limited and whose value is easily judged, before embarking upon higher flights'.

On the scientific front, one can be easily carried away by the rich patterns in chaos theory, accessible to anyone with a computing system. Clearly determinism does not necessarily imply predictability in nonlinear systems and the author likes us to believe that this has solved the dilemma of irreversibility in the micro-world derived from the reversible laws of the micro-world. However the question can be asked, whether nonlinearity is absolutely necessary? Will a purely linear system of a large number of particles show statistical/thermodynamic averaging, even though chaos will not occur in a purely linear system? One may conjecture that the answer is yes. Ergodic theories in the hands of Caratheodory, Birkhoff and others appeared to show some path with the metric transitivity of the phase space. Yet, the answer is not proved to everyone's satisfaction. As the South Indian proverb says, 'We must leave something for tomorrow'.

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The Mysterious Moon & India's Chandrayaan Mission. Narendra Bhandari. Vigyan Prasara, Dept of Science and Technology, A-50, Institutional Area, Sector-62, Noida 201 307. 2008. xix + 88 pp. Price: Rs 195. ISBN: 978-81-7480-177-7.

Yes, India has finally reached out to Moon. The success of *Chandrayaan-1* mission is a monumental achievement by Indian Space Research Organization

(ISRO). This mission has triggered the imagination of young India as never before. In the backdrop of the successful launch of *Chandrayaan-1*, it is timely that Vigyan Prasara has brought out a very interesting book on the moon, with the fond hope of rekindling and sustaining the intellectual curiosity of general public on unknown scientific facts about moon.

The moon is probably one of the celestial mysteries that most of us have grown with. The spectacle of a bright moon in the sky on a full moon day is a visual delight and this sight has fascinated mankind since antiquity. When the Americans first landed on moon in the year 1969 it virtually kick started the American space odyssey and in some sense heralded the technological advancement in the American society. Maybe the euphoria generated by *Chandrayaan-1* will also usher something on similar lines in India. With no pretensions, Narendra Bhandari has come out with a rather informative compilation on both the moon and *Chandrayaan-1*. The language in the book is that of a simple popular science article that can be easily understood by non-specialists. I personally believe that this book should find a place in most of the high schools and colleges so that most students will have an opportunity to satisfy their intellectual curiosity about the moon. This certainly does not imply that the book may not be interesting to practising scientists and engineers. Maybe the research community may find the information in the book rather brief giving the reader a feeling of watching the trailer of a very absorbing thriller movie. But the book does succeed in holding your attention till the end and does encourage you to read further about the subject.

The major part of the book is dedicated to explaining the various facets of the moon and the last few chapters of the book describes the *Chandrayaan-1* mission. The book is full of interesting colourful illustrations and photographs. The pictorial depiction of earth and the internal structure of the moon, different chemical and mineral compositions in it are very informative with clear and lucid descriptions. I am not sure if many of us knew that there are craters on the moon that have been named after Vikram Sarabhai, a renowned space scientist and well-known astrophysicist Meghnad Saha. Chapter 3 comprises interesting

information on the presence of hydrogen-bearing compounds around the north and south poles of the moon. But I am not sure if we know for sure that this also indicates the distribution of water ice as mentioned in the caption of figure 3.7.

Reading through different chapters sometimes gives you a feeling that the book has been compiled in a hurry. The information flow in different chapters is rather disjointed and there is certain lack of connectivity. Nevertheless, the utility of the book as a source of information on the moon is unquestionable. The chapter on giant impact hypothesis may not be a purist's delight. Some of the information presented on the giant impact obviously is speculative in nature and sometimes could be a bit confusing to the first time reader. But one should understand that it is rather difficult to present complex astrophysical phenomenon leading to the formation of the moon in few pages, more so in a language that students and non-specialist would easily digest.

Readers having high expectations on getting lot of details about *Chandrayaan-1* mission from this book will be disappointed. The description of the maiden moon mission is rather brief. It is evident that this book was planned and executed before the actual launch of the moon mission. Maybe the writer was a bit more conservative and did not want to sound jingoistic especially in the backdrop of umpteen number of impediments associated with such projects. Some basic details on the challenges on designing payloads for the moon mission would have highlighted the difficulties in space missions. It is important to know that *Chandrayaan-1* was the only mission to moon where 16 sophisticated instruments (although in the book only 11 have been mentioned) from different parts of the world were carried as payloads. To the



best of my knowledge, on an average only 6–8 instruments have been carried on-board in the earlier moon probes launched by other countries. It is rather amusing to note that even a developing country like Bulgaria had a payload on *Chandrayaan-1*. System integration of various payloads and thermal management would have been the biggest technical challenges in India's moon mission. The description of some of the payloads is crisp and can be easily comprehended by non-specialists.

The injection of the probe into the moon's gravitational field after breaking the shackles of the earth's gravitational field is one of the most demanding exercises in the entire mission. Many of the earlier missions had failed in this stage. Some discussion on this topic would have clearly brought out the technical challenges encountered in this mission. But again the efforts of the author should be appreciated in trying to provide a concise description of the moon and *Chandrayaan-1* without getting embroiled in lot of technical details that may overawe the students and non-specialists who would love to read a book of this nature.

I recently had an opportunity to listen and discuss with Annadurai who is the projector director of *Chandrayaan-1*. One of the startling facts that he revealed during the course of his lecture was that the total cost of the entire mission was around Rs 360 crores. In recent times, people have raised a question whether it is appropriate for a country like India where more than 70% of people are not able to spend Rs 20 a day, to carry out such fancy technological missions. In fact when I recently interacted with students from a rural suburb, a student from 9th standard did raise this question. In fact Annadurai mentioned that India can afford to have about 12 missions like *Chandrayaan-1* every month! The number of mobile phone users in India is around 50 crores. Even if they use Rs 100 to recharge every month we are already talking about Rs 5000 crores! This definitely implies that missions like this do not affect our poverty-alleviation programmes. I think no other nation on earth would have successfully completed a mission such as *Chandrayaan-1* in such a small budget. For a nation it is important to carry out technologically challenging missions from time to time and always thrive to be in the forefront of

science and technology. Only then will we as a nation be respected in the comity of nations. Without advancements in basic science, engineering and technology we can never dream of joining the bandwagon of developed nations. Nevertheless if you are looking for a quick guide to understand various aspects of moon and also *Chandrayaan-1* then you should read this book.

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Introduction to Mechanics. Mahendra K. Verma (ed.). Universities Press (India) Private Limited, 3-6-747/1/A & 3-6-754/1, Himayatnagar, Hyderabad 500 029. 2008. xiv + 341 pp. Price: Rs 290.

The science of mechanics, dealing with the motion and equilibrium of masses, is one of the oldest branches of physical sciences and has for its subject matter how and why things move. The book under review is designed to serve as an introductory text for undergraduate students of physics and engineering at the Indian Institutes of Technology. Because these students would have studied introductory mechanics in high school at the level of Halliday and Resnick¹, the book by Verma is designed to be a primer for future studies on advanced subjects in mechanics like quantum mechanics and statistical mechanics.

The book begins with a history of mechanics, forces, Newton's equations, central force problem, vibration analysis, energy and momentum and ends with an introduction to nonlinear dynamics and the special theory of relativity. Throughout, the author has made an attempt to highlight the concepts of absolute time and inertial frames, which were questioned and elegantly postulated by Ein-